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Functions 101

# Definitions:

* Independent variable- this is a variable that you can control
  + Example: time is 6 hours after midnight
  + HINT: typically your x or t values
* Dependent variable- this is a variable that is controlled by the independent variable. It relies on the independent to determine its value.
  + Example: the temperature when it is 6 hours after midnight
* Function- any relation where for each independent variable, there is only one dependent variable
* Vertical line test- a method of checking a graph to determine whether it is a function
  + HINT: use your pencil or a straight edge (drivers’ license) as a straight edge. Just make sure you are looking vertically.
* Fcn- an abbreviation for function

# Why?

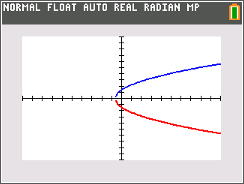
Sometimes in math, you will have several equations on the same graph. However, if you they all started with y=, how would you know which one someone was addressing? Function Notation helps alleviate this issue

This equation says: **f is a function of x** and it equals **3x+2**

**We can change the left-hand side of the equation to our hearts’ content!**

Let’ say we are dealing with time (independent variable) and height (dependent variable). We can make the equation h(t).

## http://www.clipartlord.com/wp-content/uploads/2014/03/pencil14.pngHow do I know if I have a function?

Given a Graph:

Use the Vertical Line Test.

If your pencil hits your graph (it has to be obvious) more than once at the same time, then the graph is **not** a function.

Given a Table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| X | 1 | 2 | 3 | 4 | 5 | 2 |
| F(x) | 9 | 10 | 11 | 12 | 9 | 3 |

Look for repeated x-values.

1. If they have **different dependent variables**, then it is **not** a function
2. If they have the **same dependent variables**, then it **is** a function
   1. **Note:** sometimes teachers will put the same point on their twice to see if you are paying attention.

# How else can I think about this?

Weird connection time!

Think of a function as a magic box that takes in a value (independent variable), makes a consistent change to it, and then spits out a new value (dependent variable).

This is like your oven!

You put something in (batter, dinner, pizza rolls, etc.), your oven bakes it, and then it gives you something at the end of that time.

If you put brownie batter in the oven, you bake it and you should end up with baked brownies at the end. If they get burnt, they are still burnt brownies, right? This is a function!

If you put brownie batter in the oven, and you end up getting a turkey at the end then you either:

1. Have a magic oven and you need to patent that immediately
2. Have someone who is playing a prank on you

But you definitely do **not** have a function.

# Evaluating a function

You will either be asked to evaluate the function at an independent variable or a dependent variable.

|  |  |
| --- | --- |
| Independent Variable  Find f(2)  Take the 2 and plug it in every time you see x on the right hand side  This answer is the dependent variable when x=2 | Dependent Variable  Find f(x)=4  Take the 4 and plug it in on the left hand side instead of the f(x)  This answer is the independent variable when the dependent variable =4 |

# Parent Functions and Graphing

Almost all graphs can fit in the following form:

1. Vertical stretch or shrink
2. Horizontal stretch or shrink
3. Horizontal shift (moves left or right)
4. Vertical shift (moves up or down)

The vertical components (a & k) only change the ‘y’ values and you do the same as you would assume.

The horizontal components (c & h) only change the ‘x’ values and you do the opposite of what you would think.

|  |  |
| --- | --- |
| x | y |

**Note:** dividing by c and multiplying by the reciprocal do the same thing.

# List of Parent Functions

Quadratic

|  |  |
| --- | --- |
| x | y |
| -2 | 4 |
| -1 | 1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 4 |

Cubic

|  |  |
| --- | --- |
| x | y |
| -2 | -8 |
| -1 | -1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 8 |

Square Root

|  |  |
| --- | --- |
| x | y |
| 0 | 0 |
| 1 | 1 |
| 4 | 2 |
| 9 | 3 |

Cube Root

|  |  |
| --- | --- |
| x | y |
| -8 | -2 |
| -1 | -1 |
| 0 | 0 |
| 1 | 1 |
| 8 | 2 |

Absolute Value

|  |  |
| --- | --- |
| x | y |
| -2 | 2 |
| -1 | 1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
|  |  |
|  |  |

This list is limited to the most commonly used functions that you will see in College Algebra.

# Parent Functions- Examples

Parent New Graph

|  |  |
| --- | --- |
| x | y |
| -2 | 4 |
| -1 | 1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 4 |
|  |  |

|  |  |
| --- | --- |
| x | y |
| -7 | -8 |
| -5 | -5 |
| -3 | -4 |
| -1 | -5 |
| 1 | -8 |

Follow the order of operations and go value by value.

Etc.

Parent New Graph

|  |  |
| --- | --- |
| x | y |
| 0 | 0 |
| 1 | 1 |
| 4 | 2 |
| 9 | 3 |
|  |  |

|  |  |
| --- | --- |
| x | y |
| 4 | 6 |
|  | 8 |
|  | 10 |
| 7 | 12 |

The easiest part of graphing functions this way is it gives you points to automatically plot.

Quadratics

# Multiplying Polynomials

The acronym FOIL, or double distribution, that most teachers use only works when multiplying a binomial by a binomial, like (x+3)(x-4). What happens when you need to multiply a trinomial by a trinomial? Use the Punnit Square Method.

Ex:

Take one trinomial and put it as your row, take the other trinomial and use it on your columns like so:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Multiply rows and columns, then combine like terms. Final Answer:

# Factoring by Grouping

## Why should I learn this method when I already know several?

If your school was like mine, every teacher seemed to have their own preferred method. Sometimes, that method only works in special cases.

If you already have a method that works for you, keep using it!

Factoring by grouping works with all quadratics, quadratic-in form, and some cubics, which makes it my method of choice. I will show you more complicated problems with step-by-step instructions.

Ex:

Step 1: Look for any common factors to pull out

Step 2: Identify a, b and c from the standard form quadratic. Multiply a and c, but ignore the signs.

a= 5 b=16 c=-16 5\*16= 80

Step 3: Find the factor pairs for 80. Look for the pair that can be combined in such a way to get our b term of 16.

80: 5, 16 8,10 **4,20 20-4=16!**

Step 4: Split your original trinomial’s b term like this:

Step 5: Factor the split trinomial in pairs:

\*Note: make sure that both of the binomials in the parentheses match. If they don’t match, something has gone wrong.

\*Note: put both of the factored out items into one binomial term. Make sure you remember the 2 that you factored out at the beginning.

# Factoring by Grouping:

Example 2: Step 1: Common factors? None.

a=2 b=-21 c=40 Step 2: Label and Multiply a & c.

2\*40=80

80: 1, 80 2,40 4,20 Step 3: Find factors that = b

**5,16**

-5+-16=-21!

Step 4: Split the b term & factor

p -8

\*make sure the () pairs match!

You will notice that your work will take you less and less space as you get better.

The order that you put your split b term into does not matter.

The order of your binomials doesn’t matter.

The only time you worry about your signs is when you split your b term. Make sure that if you were to put b back together that you get back to your original term.

# Completing the Square

Again, this method has a time and a place, however it is a commonly requested skill.

Example:

Step 1: move all constants to the right side of the equals sign, but leave a blank spot.

Step 2: to fill in the blanks, one must take half of the b term and square it.

Step 3: factor the left-hand side of the equation and combine the right hand side.

\*\*\*Note: the 2 that you get when you factor came from our original b divided by 2.

Step 4: Solve!

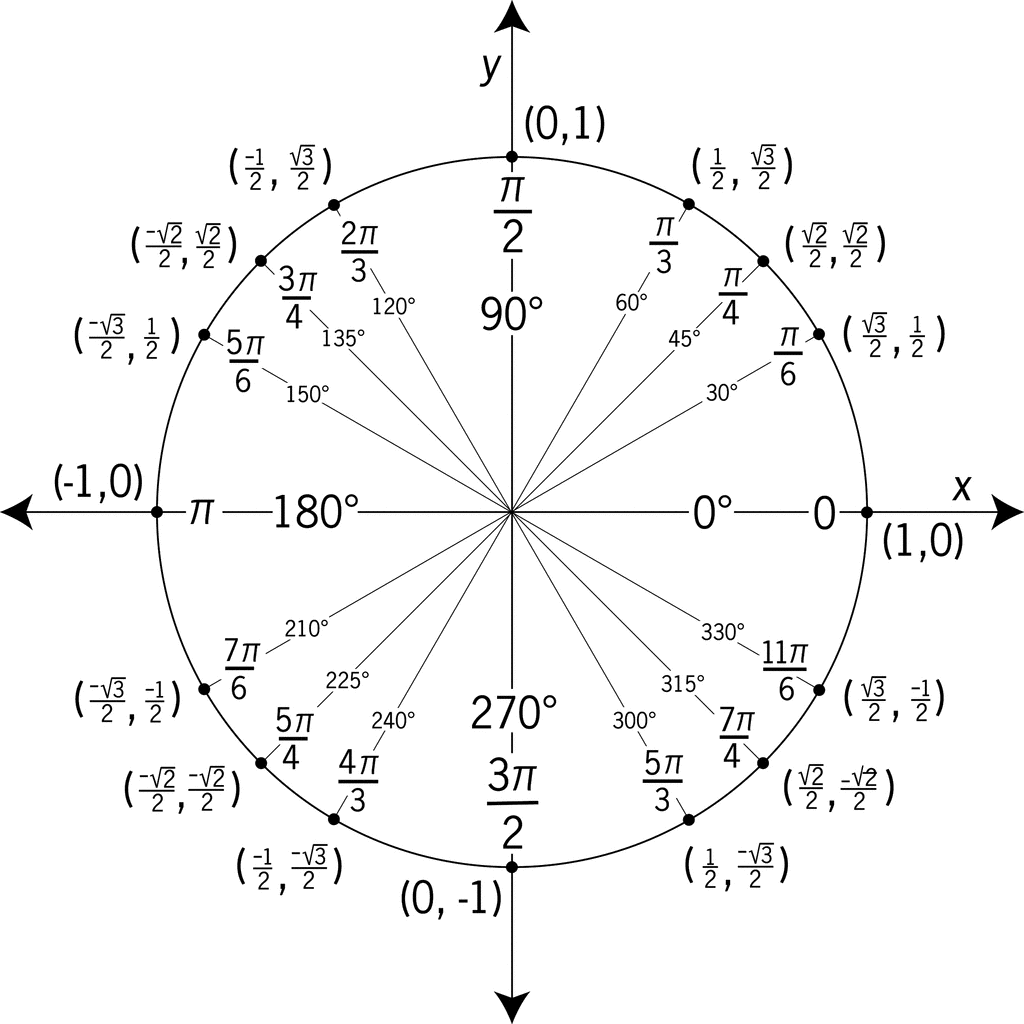
Trigonometry Basics

# The Unit Circle

I wish there was an easier way, however the best advice I can give you is to **memorize the unit circle.** There are no shortcuts with this, it is a skill that the quicker you are in retrieving the information, the better you will do. Recommendation:

* Flashcards
* Timed tests
* Fill in blank unit circles

Memorizing the unit circle is going to be the difference between struggling in MAT 182 and above, and breezing through.



# The 6 Trig Functions

Original: Reciprocal: Definitions:

O= opposite

*Sign co see cant*

A= Adjacent

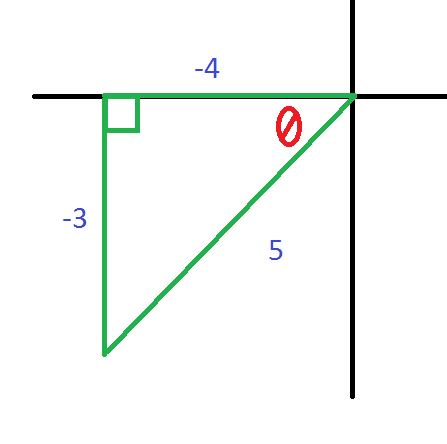
*Cosign see cant*

H= hypotenuse

*Tangent co tangent*

Example: if and , find the 6 trig ratios

Step 1: draw a picture that matches all of your given information. Because is in quadrant 3, it makes it easier to draw the triangle. Make sure that your goes in the right spot, as it should always have a side on the x-axis.



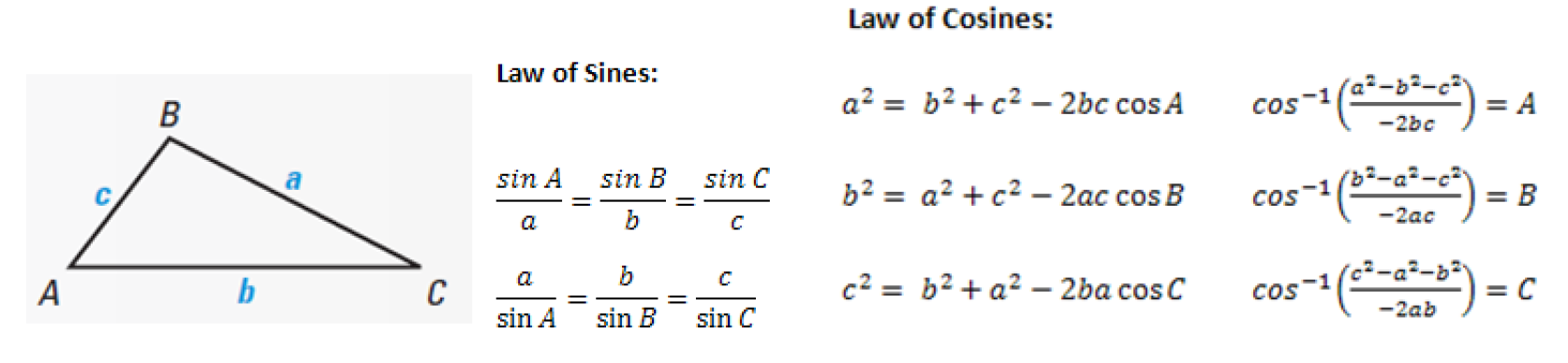
Use the Pythagorean theorem to find your missing side.

\*\*Make sure your signs match the quadrant you are located in.

Step 2: Fill in your ratios. Be sure to rationalize any radicals in the denominator.

# Law of Sines- The Ambiguous Case

Here are the formulas for finding sides and angles for non-right triangles:



Each set of equations has a time and a place, based on what you are given. Typically, if you have a complete pair, like side a and angle A, then you want to use law of sines. The tricky part is there is occasionally an ambiguous case for the law of sines.

Given: Side 1 Angle 1 Side 2 Find the missing pieces

Example: side 1 = 10 in side 2 = 16 in We have 2 solutions!

Step 1: find the first set of solutions.

→ (angle 2) → side 3= 19.8 in

Step 2: find the second set of solutions.

180- 53= 127 because 180 > 127+30, we know we have a second triangle

New → side 3= 7.8 in